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Route To:

Subject: Bark Beetle Activity in Fuels Reduction Projects on the Springerville RD (springervillerd)

To: District Ranger, Springerville RD, Apache-Sitgreaves NFs

On August 19, 2003, I traveled to Springerville to meet with Bill Ripley, District Silviculturist, to assess bark beetle activity in previous, ongoing, and future fuels reduction projects on the Springerville RD, Apache-Sitgreaves NFs. I describe in this report bark beetle activity on the Apache-Sitgreaves NFs and bark beetle activity in the project areas, summarize basic bark beetle biology, and make recommendations to minimize bark beetle impacts associated with these projects.

Bark beetle activity and biology on the Apache-Sitgreaves NFs

Aerial detection surveys conducted by our Forest Health Protection zone office in 2002 found relatively high levels of bark beetle-killed ponderosa pine on the Apache-Sitgreaves NFs. A detailed summary of the aerial detection survey results for 2003 will be provided to the Forest at a later date; however, Ips-caused mortality of ponderosa pine was found on approximately 110,000 acres, totaling almost 250,000 trees killed in 2002. This pine mortality is not unique to the Apache-Sitgreaves NFs. High levels of both ponderosa and piñon pine mortality have been documented across the state and throughout the Southwest during 2002. Within many of these areas, ponderosa pine mortality is already greater than 25% for a given stand and as high as 90% in others. The vast majority of this pine mortality is related to the ongoing drought that the Southwest Region has been experiencing since 1996. If beetle populations continue to increase at the rate they have over the past few years, we can expect to see even greater levels of mortality throughout much of the forest.

Inspection of fading trees and collected specimens determined that the pine engraver beetle (*Ips pini*) is the primary cause of ponderosa pine mortality on the Springerville RD. This bark beetle is widespread throughout the West and can occasionally reach outbreak proportions (Kegley, et al., 1997). Most of the attacked trees show the characteristic fading from the top down associated with *Ips* attacks. Many of the larger diameter pine with top kill also have western pine beetle (*Dendroctonus brevicomis*) in the lower portion of the trunks. Other bark beetles species are present in ponderosa pine forests across the Forest, but are not considered tree killers (i.e., red turpentine beetle (*D. valens*)) or are at very low populations (i.e., other *Ips* species and roundheaded pine beetle (*D. adjunctus*)).

Pine engraver beetles. Adult pine engraver beetles attack smaller diameter trees and tops of larger trees, but their preferred host material is fresh pine debris from construction, logging, firewood cutting, or wind and snowstorms. Living trees can be attacked and killed once populations have built up in fresh pine debris. Several generations are produced per year. Adults emerge from overwintering material and fly to find new hosts in the spring (i.e., early April). Pine engraver beetles flights continue into the fall as long

as daytime temperatures remain above 60° to 65° F. Generation time from egg to mature adult beetle ranges from one month to 8 weeks, with the shortest development time in mid-summer. Males initiate attacks and release chemicals which attract females. Adults build galleries (or tunnels), mate, and lay eggs. Galleries are distinctive. Typically, there is a central nuptial chamber (an enlarged area) from which several more or less linear adult galleries radiate. Galleries slightly etch the sapwood, hence the common name, engraver beetle. Frequently three galleries originate from the nuptial chamber in the shape of a tuning fork. Adult galleries are open and not packed with boring dust. Larvae (immature beetles) feed in their own galleries perpendicular to the adult galleries for a few weeks before pupating. Pupae turn into adults to complete the cycle. Evidence of attack includes fading foliage, red boring dust in bark crevices, and, occasionally, small pitch tubes on trunks of live trees. Because attacks are typically initiated near the tops of trees, the crown fades from the top down.

Western pine beetle. The western pine beetle attacks trees of all sizes larger than 6 inches in diameter. However, large, old trees are attacked most commonly. Unlike the pine engraver beetles, this insect attacks living trees and rarely is found on pine debris. Best evidence of attack is the presence of pitch tubes (up to 1 inch in diameter) on the bark and bark crevices. Under the bark, galleries are mazelike and do not etch the wood (in contrast with pine engraver beetles). Their life cycle is similar to engraver beetles. Between two and four generations are produced per year. Flight and attacks start in late spring or early summer and continue until the onset of cold weather in fall. Attacks are initiated by adult females, usually at mid to lower trunk. The infestation process is mediated by chemical messengers or pheromones released by the beetles in combination with host tree chemicals. Adults construct egg galleries. They differ from pine engraver beetles galleries in their shape and by the fact that they are packed with boring dust. Larvae feed in their own galleries perpendicular to the adult galleries. Later larval stages tunnel in the middle bark before pupating and eventually emerging. One generation requires between 2 and 10 months, depending on temperature.

Bark beetle activity in fuels reduction projects

On August 19 and 20, Bill and I examined several of the previous, ongoing, and future fuels reduction projects. A brief summary of treatment prescriptions and bark beetle activated is provided for each area in the order they were visited.

Montlure Fuels Reduction Project – This project along the east side of Forest Road (FR) 8079 included a prescription for thinning all ponderosa pine less than 12 inches in diameter at breast height (DBH) in the fall of 2002. In accessible areas, the logs were removed from the site and tops were chipped on site. The contractor raked chips away from the bases of residual trees. Some of the chips were used to prevent erosion along skid trails. In areas that were too steep or inaccessible, the contractor bucked the logs into 14-inch lengths and piled the branches and tops. This smaller diameter material will be burned later this year. We examined both areas for beetle activity. In general, sparse bark beetle activity was observed in standing residual trees and primarily limited to trees severely infected with dwarf mistletoe. Slash and the 14-inch bolts were either previously utilized by *Ips* or are currently infested (primarily the portion facing the ground). It seemed that this material had been more heavily colonized along the steep slopes

than on the exposed ridge top. An additional 30 acres will be thinned in and adjacent to the Montlure Church Camp in the fall of 2003.

Badger Knoll Fuels Reduction Project – This project along the east side of FR87 included a prescription for thinning all ponderosa pine less than 9 inches DBH in the fall of 2002 and winter of 2003. Slash less than 6 inches in diameter was chipped on site and 6- to 9-inch logs were lopped. Ten acres were completed in the fall of 2002, and another 30 acres further up the road are scheduled for the fall of 2003. Previous treatment on this contract occurred the fall of 2001. Similar to Montlure, little bark beetle activity was observed in the standing residual trees (approximately 3 trees), but beetles had or are currently using the larger diameter slash. Several severely dwarf mistletoe-infested pine have been attacked adjacent to this and previous projects on the uphill side of FR87.

Another 1,000 acres around Greer is scheduled for thinning in the fall of 2004.

Iris Springs Winter Range Restoration Project – This area north of State Highway 260 is scheduled to have all ponderosa pine less than 9 inches or 12 inches dbh (depending on the individual stand) cut and lopped, or potentially removed from the site. Many of the trees in these stands are relatively open-grown, and little current bark beetle activity was observed**.**

Ranch 2 Fuels Reduction Project – 200 acres of thinning along the west side of FR118 was completed in the fall of 2002 through January 2003. The logs from this project are currently still on the ground, but are scheduled to be self-loaded to FR118 and then transported to Snowflake in September 2003. Logs on the ground have already been or are currently being utilized by Ips. No beetle activity in the residual trees was observed. Approximately 10 trees were previously or are currently attacked on the east side of FR118.

Ranch 1 Fuels Reduction Project – 200 acres of thinning along west side of FR118 was completed in the fall of 2002 through January 2003. All logs were removed from the site in May 2003. No bark beetle activity was observed in the residual stand at this time. *Ips* activity was noted in late April within the log decks. Removing this infested material from the site may have reduced local populations of *Ips.*

Figure 1. Thinned stands and piled slash within the Hay Timber Sale.

Ranch 3 Fuels Reduction Project – This project is scheduled for 2004 and lies between Ranch 1 and Ranch 2 projects. Low levels of bark beetle activity were detected throughout the area at this time.

Hay Timber Sale and KV Projects – Several stands within the Hay Timber Sale west of State Highway 261 and north of FR409 were visited. This timber sale occurred over approximately 6,000 acres beginning in 1989. Many acres have had subsequent KV work to reduce dwarf mistletoe infection throughout ponderosa pine overstory and to favor tree species other than ponderosa pine; i.e., aspen, Douglas-fir, and southwestern white pine. In some stands logs were removed from the site, and tops and limbs

were burned or will be burned (Figure 1); while in other stands, logs up to 13 inches were bucked to 14 inches in length and left on site. In general, little bark beetle activity was present within the residual trees; however, some trees were killed in the process of burning slash piles. In the Long Point area, no current bark beetle activity was seen within the treated areas (Figure 2), but adjacent untreated stands that are heavily infested with dwarf mistletoe considerable beetle activity is present (Figure 3). In some areas, the larger diameter slash that was bucked to 14 inches had been utilized by *Ips* beetles, while in other areas, there was very little or no evidence of beetles using this material (O.D. Hay Contract).

Figure 2. Thinned stands with slash piles burned and logs removed from site in Long Point.

Figure 3. Untreated stands infested with dwarf mistletoe and bark beetles in Long Point.

Recommendations

I provide here general preventive measures for future fuel reduction/thinning projects and then provide more specific recommendations for current projects on the District. Most of this information is included in the Integrated Pest Management Guide for *Ips* species attacking ponderosa pine (Parker, 1991).

The best preventive strategy to minimize *Ips* activity related with thinning projects and associated slash is to utilize the larger diameter slash. Harvesting most ponderosa pine slash larger than 4 inches in diameter will help to prevent beetle population increases, because few beetles are produced in slash less than 4 inches. The larger diameter slash should be removed from the site or treated (chipped) within 28 days of being generated if thinning occurs during active beetle flight periods (April through the end of September at elevations above 8,000 feet). If thinning occurs during November through March, the larger diameter material should be removed or treated before the time beetles complete their first generation in the spring (i.e., by early May). If slash does become infested in April, removing or treating the newly infested material may aid in reducing the local population of *Ips* beetles.

In general, beetle population increases can be minimized by implementing thinning projects after the onset of the monsoon season (mid-July) through December. Cutting trees during this season

will allow the material to partially dry out before beetles fly in the spring. Also, standing residual trees may be less susceptible during this time. Slash generated from January through May remains moist and enhances beetle population increases. While this is a good general recommendation when beetle populations are relatively low, we have observed *Ips* species to complete at least one generation in slash generated during the fall of 2002 on most Forests in Arizona. If this timing approach is being used and trees are only lopped and left on untreated on the site, there are a couple points to consider. First, slash generated on more exposed areas that have relatively flat land and low residual basal area will likely dry out by the time beetles fly in the spring. Second, on steeper slopes or where the residual basal area is still relatively high, slash may not adequately dry out by the time beetles fly in the spring. These differences in slash colonization were noticed at Montlure (steep slopes) and the O.D. Hay Contract (exposed site with low basal area).

Another general "rule of thumb" approach to preventing *Ips* beetles from impacting areas where thinning projects are being implemented is to separate project areas either in time and/or in space. Beetle populations probably will remain relatively low if projects are conducted every other year. Similarly, a buffer of over two miles between management areas is also thought to prevent mass movement of beetles from one area to another. This is important information to keep in mind for ongoing projects in the Greer area, especially if an additional 1,000 acres are to be treated beginning in the fall of 2004. At some of the areas visited near Greer (e.g., Badger Knoll), there have been thinning projects for consecutive years in adjacent stands. Although this has not resulted in excessive mortality to residual trees, there likely has been a buildup of *Ips* beetles that have moved from one thinning project to the next. This scenario somewhat resembles an approach used in the north Rocky Mountains, where *Ips* populations are regulated through "green chaining." As long as there is new and suitable slash, the beetles stay in this material and do not severely impact thinned stands. However, if the slash food supply is cut-off, the beetles may move into standing trees. I would caution against this approach in Arizona, as there can be numerous factors that may result in the "breaking of the chain."

Also, I would like to add a word of caution about chipping fresh slash. Although no experimental studies have been conducted to examine the relationship between chipping and bark beetle attraction, we do know that bark beetles are attracted to host tree compounds such as terpenes. Fresh-cut trees and chips release high quantities of terpene volatiles that can attract bark beetles. To minimize the potential of chips attracting bark beetles, chips should be spread out as much as possible in open areas, rather than in shaded areas, or removed from the site. Try to prevent piling the chips at the bases of pine trees. If the chips are spread out in a thin layer and out in the sun, they will dry quickly and, therefore, stop emitting terpene volatiles. Chipping in the fall probably has less risk than chipping at other times of the year.

Montlure Fuels Reduction Project – Be cautious in the new 30 acres to be treated in the fall of 2003. You may want to require that all slash greater than 4 inches in diameter be removed from the site or treated before May 2004; for example, consider chipping 4 to 9 inch diameter and then removing the 9 to 12 inch diameter logs.

Badger Knoll Fuels Reduction Project – Similar to Montlure, be cautious in the new 30 acres to be treated in the fall of 2003. Precautions could include: 1) waiting one year before implementing this prescription; 2) requiring that all slash greater than 4 inches in diameter be removed from the site before May; 3) chipping all slash between 4 to 9 inches, piling and

burning limbs and slash less than 4 inches in diameter. If there is concern that beetles are still present within the existing larger diameter slash on the ground, this material can still be chipped or perhaps scorched with a Terra Torch. Allowing the larger diameter slash that will be generated this fall to be infested in the spring of 2004 and then either chipped or removed before May would potentially help to reduce the local populations of beetles. Similar to potential problems with the green chain strategy, there should be language in place to ensure the infested material is removed or treated before the beetles emerge later in May.

Ranch Fuels Reduction Projects and Iris Springs Winter Range Restoration Project – Bark beetle activity within this area north of State Highway 260 appears to be relatively low. See above comments on separating thinning projects in either time and/or space. In this regard, it may be warranted to wait one year before initiating the thinning project in Iris Springs, particularly if a lop and scatter treatment approached is used.

Hay Timber Sale and KV Projects – Most of the treated stands appear to be in good condition, with little beetle activity. In stands that have had or will have larger diameter slash bucked to 14-inch lengths, there may be associated tree mortality either within the treated stand or in adjacent untreated stands. The previous work to reduce the amount of dwarf mistletoe in the overstory and promoting tree species other than ponderosa pine will help to reduce the overall stand susceptibility to bark beetles attacking ponderosa pine.

Potential restrictions or conservative actions, such as requiring contractors to remove fresh slash greater than 4 inches in diameter from the project site within 28 days, should be considered temporary. That is, once *Ips* populations decrease to endemic levels and precipitation levels return to unfavorable conditions for beetle population increase, less restrictive contracts can be implemented; for example, relax chipping restrictions or timing restrictions.

If you have any questions regarding my assessment of current bark beetle activities within the project area, its potential effect on residual standing trees, or my recommendations, please let me know. I can be reached at (928) 556-2074 (or jmcmillin@fs.fed.us).

/s/ Joel D. Mcmillin
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